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New Partnerships in Africa RISING to reach impact at scale

By Christian Thierfelder and Peter Setimela

The International Maize and Wheat Improvement Center (CIMMYT) has been supported by the United States Agency for International Development (USAID)'s Feed the Future initiative in Eastern Province of Zambia since 2011. Feed the Future is the U.S government's global food security program initiated by President Obama.

Project activities started in 2011 under the auspices of the Sustainable Intensification of Maize-Legume Systems in Eastern Provinces of Zambia (SIMLEZA) project, which later expanded to SIMLEZA-Africa Research in Sustainable Intensification for the Next Generation (Africa RISING). Since 2015/2016, Africa RISING has taken the lead in project implementation and four major themes are currently supported under Africa RISING: a) legume seed scaling; b) orange-fleshed sweet potatoes; c) the use of Aflasafe and finally d) sustainable intensification of low-input agriculture systems (SI).

The SI theme has focussed on outscaling of successful products from the first SIMLEZA phases. The technology focus in eastern Zambia was on conservation agriculture systems and its management components, besides drought tolerant (DT) and bio-fortified maize (for example quality protein maize-QPM). CIMMYT continues to implement these proven technologies with the help of the Ministry of Agriculture and Livestock, the Zambian Agriculture Research Institute and the regional non-governmental organization (NGO) Total LandCare (TLC), and seed companies and aims to reach at least 5000 farmers in the current project phase.

With the advent of the 2015/2016 cropping season, new partnerships have been forged and are starting to generate impact at a much larger scale in the three target districts - Chipata, Sinda and Lundazi.

CIMMYT, supported by Africa-RISING, formed a strategic alliance with the Catholic Relief Services (CRS) to expand the work on green manure cover crops (GMCCs) through on-farm validation trials and demonstrations. Some on-station trials have also been established to validate the performance and impact of green manures on soil quality, productivity and weed control. At present, there is too little knowledge on how GMCCs perform in conservation agriculture (CA) systems under the environmental conditions of eastern Zambia, and Africa RISING will address this knowledge gap.

The second new partnerships has been through engagement of the local NGO Grassroots Trust, who provide expertise in green manure cover crops and new and more efficient ways of farm yard manure handling. Finally, CIMMYT engaged with the Community Market for Conservation (COMACO) to analyse their Gliricidia-maize intercropping system more scientifically. This work has further been expanded to cowpea seed production with additional funds availed by the USAID Zambia Mission.

New partnerships with development organizations will be key to achieve greater impact at scale through Feed the Future. These organizations will not only be available for co-development of technologies but also help in reaching out to many more farmers to encourage the use of technologies that are more productive, profitable and adapted to the environments of eastern Zambia.

Doubling-up legumes gives farmers more from their land

By Christian Thierfelder and Mulundu Mwila

It was a hot day in February 2016 when the Africa RISING project team visited on-farm trials in Chipata District of Eastern Province. The team examined the doubled-up legume trials where groundnuts are planted in association with pigeonpeas – a new system in eastern Zambia that offers farmers the benefits from two cash crops. Both crops seemed to grow well despite the seasonal dry-spell experienced during this seasonal period.

The theory behind doubled-up legume systems is that some legumes can be grown together on the same piece of land without major competition for water and light – which often happens when maize is intercropped with a legume. Groundnut, a drought-tolerant crop as well as the deep rooted pigeonpea are ideal partners as the pigeonpea has a very slow initial growth and once groundnuts mature, the pigeonpea will start shooting up and develop a full canopy. Residual nitrogen effects from this system are also much greater compared with growing both crops individually. Africa RISING has been promoting this system on farmers' fields since 2013 and has gained considerable experience in the last years. As opposed to a sister project in Malawi, the systems tested here are both planted side-by-side under conventional ridge-tillage systems as well as under no-tillage with residue retention.

Photo: Christian Thierfelder

The objective is to explore how climate resilience of a double-up legume system increases if planted under the water saving conservation agriculture (CA) technology.

Doubled-up legume systems with groundnuts and pigeonpea under CA offers additional benefits for farmers. By avoiding the ridging, farmers save significant labour as has been observed by USAID`s Senior Agriculture Sustainability Adviser, Jerry Glover, and Sieglinde Snapp, Professor at Michigan State University, both of whom visited the site on 18th of March, 2016. "[It is] nice to see - the trials did really well without the back-breaking ridging work", Glover said, which gives labour-constrained households great hope and a viable alternative to the current practices.

Besides reduced labour on planting, the better spatial arrangement under CA allows to plant groundnuts at half the row spacing of 37.5cm rows instead of planting on ridges at 75cm which exposes the groundnuts to increased run-off, moisture evaporation and rosette disease which occurs much more frequently when the canopy is more open. Finally and most importantly, a higher plant population increases the grain yields of groundnuts.

Sustainable intensification (SI) of current farming systems means that farmers produce more from a given piece of land area while being profitable, equitable and socially acceptable. The successful combination of several crops on the same piece of land is a clear SI strategy and offers farmers new options to intensify low-input agriculture systems in a very potential and effective way. The increase in price for a kilogram of pigeonpea grain, fueled by a high demand from the Indian market, to approximately US$1.8-2.0 per kg of grain will make this system financially more attractive than even tobacco, the cash crop which is commonly regarded as the most profitable in southern Africa.

The task of the Africa RISING team now is to transfer the encouraging results from the doubled-up legume trials to the local farming community in a user-friendly way. The widespread uptake of the doubled-up legume system in southern Malawi shows that transformation to more profitable ways of farming is possible in a fairly short period of time.

Below: Senior Agriculture Sustainability Adviser Jerry Glover, USAID and Professor Sieglinde Snapp, Michigan State University visiting doubling-up legume sites under CA in Chipata Districts in March 2016.

Conservation agriculture – a system to adapt to climate variability and declining soil fertility

By Christian Thierfelder

Conservation agriculture (CA) is a crop management system based on three principles: a) minimum soil movement (i.e. no soil inversion by tillage; b) soil surface cover with crop residues and/or living plants; and c) diversification through crop rotations and intercropping.

Besides these three main principles, CA depends on good agricultural practices (e.g. adequate fertilization, weed control, timely planting, improved varieties among others) to show its greatest benefits. Most crops can be grown successfully under CA in Africa and there are large areas of maize, cowpea, soybeans, groundnuts, cotton, sunflower and many other crops grown under this system. Even root crops, including potatoes and cassava, can be successfully produced under CA. Unlike in other parts of the world where CA has been successfully extended, its adoption has been largely focused on smallholder farms in Africa with the exception of South Africa, where it is practiced on large-scale commercial farms.

Conservation agriculture systems have been successfully tried and tested in eastern Zambia since 2011. More than 20,000 farmers have been exposed to CA by SIMLEZA-Africa RISING, the predecessor project of Africa RISING, which continues to sensitize and train more farmers. Farmers benefitted from increased use of CA technologies by gradually increasing crop yields leading to a solid yield benefit of 117% (1942kg ha-1) in a manually direct seeded maize crop following cowpea as compared with the conventional practice in the 2014/2015 cropping season. Rip-line seeding led to a 109% yield benefit (1993 kg ha-1) as compared to the conventionally tilled practice. It is the years with seasonal dry-spells and erratic rainfalls, such as this last El Niño year, where CA provides its greatest benefits to smallholder farming systems.

Large out-scaling of CA and its components is currently happening through mother-and-baby trials in Chipata,

Photo: Christian Thierfelder

Lundazi and Sinda and compliment other out-scaling initiatives implemented by the Catholic Relief Services and the Conservation Farming Unit in the Zambian Ministry of Agriculture.

The principles of CA appear to have extremely wide adaptation, and CA systems are currently used by farmers under a wide range of environmental conditions. CA has been tried and tested in areas of sub-Saharan Africa above 500mm of annual rainfall to more than 1500mm of rainfall, from sandy to loamy clay soils and on altitudes from sea level to more than 3000 m.a.s.l. Nevertheless, the techniques to apply these principles depend on climate, soil and farmer circumstances (wealth, land size, traction owned, labour availability etc.). CA does not work well under waterlogged and very arid conditions or on completely degraded soils.

Combined with good crop management and improved agronomic practices, CA can deliver a range of short-term and longer-term benefits to farmers, which increase crop productivity and contribute to a sustainable environment and natural resource management in the medium to long term. The aforementioned benefits of rotations help control pests and diseases as well as ‘fertilize’ the following

crop, while minimum soil disturbance and crop residue retention reduce soil erosion and runoff, increase water infiltration, and improve some physical, chemical and biological properties of soils. Yield benefits can typically be achieved in 2-5 cropping seasons, especially in drought-prone, rain-fed areas. Studies in Malawi have shown that appreciably high net returns can be attained due to reduced farm labour for planting (approximately 25-31 labour days ha-1) and for weeding (another 12-15 days ha-1). Combined with increased productivity this contributes to an extra net benefit of between 173-658 USD ha-1 in CA cropping systems compared with the conventional ridge and furrow systems. Other studies have shown that the adoption of a combination of CA-based practices - as opposed to single interventions, contributes to greater productivity, food security and resilience in maize-based systems in Eastern and Southern Africa. Successful examples of its widespread adoption already exist from Malawi, Zimbabwe and Zambia.

However, there is a range of technological challenges to successful CA implementation that require adaptation to the farmer circumstances. These challenges include: a) the need to retain sufficient crop residues, which can be difficult in intensive crop-livestock systems; b) weed control in the initial years of conversion to CA – if no herbicides are used; c) the availability of critical inputs and machinery; d) the need for profitable crop rotations; e) knowledge and capacity of farmers and extension agents to apply the principles of CA in the correct way and at a certain standard.

Successful adoption of CA systems often hinge on the presence of some key enabling factors. Where labour is a major constraint, farmers easily adopt labour saving planting techniques and weed control practices. Improved planting implements such as planting with a pointed stick or in rip-lines or using herbicides for weed control made the technology move very fast. CA has also been adopted in areas were in-seasonal droughts or dry-spells affect general crop production and water-saving systems can decide if farmers can produce a crop or not. Strong extension support in the initial years through participatory adaptation, farmer-to-farmer exchange, study tours and field days have helped farmers understand the technology and facilitated faster uptake. Finally, markets and the demand for specific crops have made CA and its inter- or rotational crops have led to more rapid spread of CA technologies.

Below: Mr Mulundu Mwila, ZARI, standing in front of Gertrude Banda's trial and showing the performance of conservation agriculture and a conventional ridge tillage.

Photo: Christian Thierfelder

Good agriculture practices – the low hanging fruits

By Christian Thierfelder

It is widely accepted that improved maize germplasm will only express its yield potential under optimum agronomic management such as timely planting, optimal plant/space arrangements, efficient fertilization; productive rotations and timely weed and pest control. Good agriculture practices (GAPs) are the low-hanging fruits for extension of new technologies. They are easily adoptable, give farmers an immediate benefit and help in the gradual shift from traditional plough or hoe-based systems with maize monocropping to more sustainable and adapted ways of agriculture.

It is against this background that the Africa RISING project theme on Sustainable Intensification of Low-input Farming Systems has intensified the outscaling of simple component technologies in a mother-and-baby trial approach in three Districts of Eastern Province, namely Sinda, Chipata and Lundazi.

Most smallholder farmers in eastern Zambia are faced with labour and cash constraints. Component technologies that critically address these constraints are therefore likely to be adopted much faster and more efficiently. Based on previous technologies that have been adapted to this environment under Africa RISING, the project has offered farmers to choose from four types of technologies to be tested on their own farm in their own environment. These have been: a) direct seeding with a dibble stick or in riplines; b) improved weed control with herbicides; c) improved rotation; and d) intercropping systems of maize with cowpeas. These have been out-scaled to more than 700 farmers' fields in 2015/2016 and the project intends to reach more than 5000 farmers in this project phase.

The interest of farmers for these component technologies has been remarkable in the 2015/2016 cropping season, as more than 3000 farmers have attended field days and evaluation meetings. Although the trial plots are small, it gives farmers an insight on what the technology can do and how it can be adapted to their own environment.

Above: Mrs. Gertrude Banda proudly shows her maize crop planted under conservation agriculture.

Diversification with cowpeas provides new opportunities for smallholders

By Maambo Mudenda and Christian Thierfelder

Drought-tolerant cowpeas have become an attractive crop among rural Zambian farmers, thanks to USAID's Feed the Future initiative in Eastern Province. Cowpeas are now more frequently used as both food and cash crop in the Eastern Province, due to their high nutritional value for household consumption and an increase in local market demand. Africa RISING supports this development by promoting crop diversification as part of its broader agricultural technological interventions and as an integral part of conservation agriculture.

Forty-year old Thomas Banda is one of the farmers who has benefitted from project activities. Based in Chanje Village in Chipata District, he farms with his wife and seven children. For years he grew only maize, using the conventional ridge and furrow planting method, but produced only low yields, barely enough to feed his

Photo: Maambo Mudenda

family. This conventional practice, with a strong focus on monocropped maize, limits the country's agricultural productivity and leaves farmers vulnerable to a variety of problems, including pests, market fluctuations, and the effects of global climate change.

For Thomas Banda this changed in 2014, when he became a beneficiary from Africa RISING. In a field day conducted by the Africa RISING Project, Banda volunteered to be a "legume intercropping baby-trial" host from the 2014/2015 farming season onwards. The baby trials are a scaling tool used by Africa RISING to make farmers aware about the technology and to gain first hand experiences with a technology on a small plot. Banda's motivation to participate was also to start practicing and adopting conservation agriculture technologies using an animal traction ripper.

From the 2015/2016 cropping season onwards he decided to grow cowpeas on one acre of his own land. He accessed cowpea seed from a local seed grower and also used recycled cowpea seed from his baby trial. Despite the poor rains experienced and prolonged dry spells during the farming season, growing cowpea on Banda's fields led to considerable increases in both productivity and income at his farm. He managed to harvest 289kg of cowpea, which translates into an overall yield of 723kg ha-1. From his harvest, he sold 250kg of cowpea to local buyers at K5 (US$0.5) per kg and reserved 39kg for home consumption. When asked what he used the money for, he happily replied in Chichewa; "ninagulamo Nkhumba yaikazi pamtengo wa K600 ($60), komanso zina tinasewenzetsa panyumba monga kugula uniform ya mwana wa sukulu ndi zofunikila zina zakusukulu", which translates to "I bought a pig at the cost of K600 ($60) and then used the rest of the money to buy a new school uniform and other school requirements for my child". Convinced about his initial success, Banda plans to expand the area of planting next year.

Planting cowpeas, a drought-resilient crop, will be one of the strategies to adapt to the negative effects of climate variability and change. Studies show that Zambia will face longer and more intense droughts as well as heat stress in future years. Additionally, the legume has a multitude of other advantages such as bringing gradual improvements in soil fertility, providing groundcover, feed for cattle and goats, nutrition through green leaves and, of course, grain that can be either consumed or sold. The varieties developed and promoted by USAID's Feed the Future program are well adapted to the environment and will help farmers to diversify the current cereal-based cropping systems.

Planting cowpeas, therefore, provides a new income-generating opportunity for smallholder farmers under Africa RISING, a project which aims to achieve long-term, sustainable economic growth and improved food and nutrition security for rural communities in Eastern Province of Zambia.

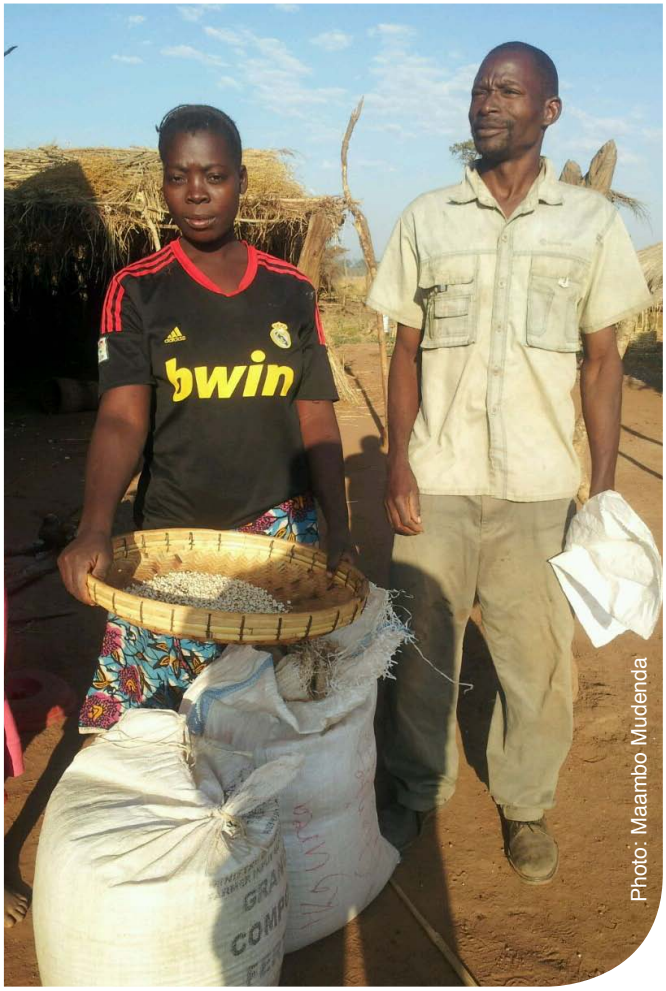

Photo: Maambo Mudenda

Left: A sow bought from cowpea sells in 2016.

Right: Thomas Banda and his wife showing their produce.

Addressing smallholder farmers' needs with green manure cover crops and agroforestry

By Christian Thierfelder and Sebastian Scott

In Africa, mineral fertilizer remains a scarce, expensive and risky resource for most smallholder farmers. On average, farmers use less than 10 kg/ha of NPK fertilizer, and many do not apply it at all. The price of fertilizer is 3-5 times higher in Africa than in Europe due to the lack of infrastructure and production facilities, often making it unaffordable and sometimes inaccessible to farmers. Fertilizer is primarily applied to higher value and horticulture crops that, unlike maize, give farmers greater return on their investment. Farmers in southern Africa plant maize extensively on large areas, harvest less than 2 tonnes/ha on average, extracting already depleted nutrients from the soil while trying to become food secure and escape from poverty – an impossible task!

In Eastern Province of Zambia, farmers are being offered a range of solutions by Africa RISING that provide a way out of this poverty trap. These technologies, options and approaches include drought and stress tolerant maize germplasm, conservation agriculture (CA), improved rotation and intercropping with grain legumes, agroforestry and green manure cover crops.

The use of CA principles (minimum soil disturbance, crop residue retention and diversification through rotation and intercropping) hinges on the ability of farmers to retain sufficient surface crop residues to protect the soil from erosion, runoff, evaporation and excessive temperatures. However, farmers in mixed crop/livestock systems face competing demands for these residues because they also feed them to their animals. Green manures and selected agroforestry species are therefore grown to improve the soil, generate biomass for ground cover and provide fodder; some also produce high protein grain for food, feed or for sale on the market.

For the past six cropping seasons, CIMMYT and its partners have tested a range of species. Crops such as velvet bean, lablab, cowpea, sunnhemp, jack bean, pigeonpea and Gliricidia, have been identified as viable options with great potential for smallholders. In some cases, they can provide 5-50 tonnes/ha of extra biomass for groundcover and/or fodder, leave up to 350 kg/ha of residual nitrogen in the soil and in most cases, do not need extra fertilizer to grow.

The Africa RISING project is testing these species, in full rotation or intercropped with maize, on farmers' fields and on-station to identify the best possible options and arrangements. "We mostly like cowpea, pigeonpea and lablab, because they provide grain and soil improvement at the same time. We are not sure yet about jack bean although we have seen that maize that is grown after jack bean has higher yields," Mr Paul Mbau from Chiparamba said. To increase adoption, the project is using an intensive participatory process to adapt the green manures to the needs and conditions of smallholder farmers.

On project sites managed and implemented by our project partner CRS, farmers discovered that maize intercropped with green manures has other benefits. Mr Shadreck Sakala from Samuel Camp in Chipata highlighted: "Both of the plots where maize was intercropped with cowpea and lablab did much better in the dry spell and they only needed one weeding as compared with two or three on other plots". COMACO, another partner under Africa RISING has gained long-term experience of up to 5 years with a maize-Gliricidia intercropping systems which is now under trial testing to better understand the dynamics and yield effects of this very potential intercropping system on maize.

CIMMYT and its partners CRS, TLC, COMACO and Grassroots Trust will further explore new ways of integrating green manures into smallholder farming systems so they become the status quo, not just an option!

Right: COMACO Gliricidia/maize intercropping field

Photo: Christian Thierfelder

Improved manure management – getting more from a limited resource

By Sebastian Scott

In cropping season 2015/2016, Africa RISING expanded its work under the Sustainable Intensification theme to trials on improved manure handling. This work is led by Grassroots Trusts in collaboration with CRS.
Many small holder farmers across the world rely on livestock manure as a cheap and effective source of the nutrients required for crop growth. The use of manure can also bring other benefits to soil function, such as improved soil biological activity, increased water holding capacity, increased infiltration rates and improved soil structure.

It is perceived that the main constraints farmers face in terms of manure use are: a) the availability of manure in sufficient quantity and b) the labour associated with hauling and applying manure in the field. The standard recommendation for manure application in Southern Africa for cereals such as maize and sorghum is somewhere between 10-20 tonnes per hectare, which is equivalent to the manure of 10-20 fully grown cattle. Very few


Photo: Sebastian Scott

farmers have access to this quantity of manure, even when it is applied on a rotational basis. The basis for current recommendations has its root in the theory of nutrient replacement. Indeed analysis of farm yard manure (FYM) reveals very low nutrient content in comparison to the nutrients found in fresh manure.

Over the past two decades, there have been studies that indicate that manure handling methods have a huge impact on the final nutrient content of FYM. Overall increases in nutrient content of FYM is basically due to protection from volatilization and leaching. Other studies also suggest that timing and placement of manure can have a significant influence on crop response and overall crop yield. Grassroots Trust has had good results both on their research farm and with on-farm trials in central Zambia.

In line with these recent insights, trials were designed to inform farmers about best practice regarding efficient and effective manure management for cattle, goats and pigs in Eastern Province of Zambia. Mr. Osward Ng›ombe a farmer from Kwenje camp, Chipata district commented: “We are interested to see if there is any difference between our manure and manure managed this new way - we thought manure was manure”.

In the first phase of this project 12 farmers were selected through the CRS-MAWA program to participate in on-farm ‘improved manure management’ for a two-year period. Training was carried out by Grassroots Trust on manure storage and in field management for the 12 farmers and 8 CRS-MAWA staff. Each farmer built a facility for improved manure storage. These storage facilities were built with local materials and some plastic sheeting and nails.

Validation plots were selected by farmers and CRS-MAWA staff. These trial plots will measure the differences in manure management efficiency between manure which has been managed using traditional management methods and those proposed by Grassroots Trust. First results from this work are expected in cropping season 2016/2017.

Left and above: Farmers in Chipata showing their new manure collection structures

Prospects of Quality Protein Maize in Zambia

By Peter Setimela and Oswell Ndoro

Maize is Zambia's staple food. It is estimated that about 85-140 kg of maize are consumed per person per year. Smallholder farmers in the Eastern Province of Zambia obtain approximately 50% of their daily energy from ordinary maize which contains relatively little protein compared to legumes. Overreliance on maize as the staple food leads to protein malnutrition and other associated diseases. It is therefore critical in areas of high maize consumption to provide smallholder farmers with cheap and alternative sources of protein, as farmers often cannot afford more expensive high-protein food such as milk, eggs, or meat.

The development and the dissemination of bio-fortified maize which contains more essential amino acids have been long-term goals of CIMMYT's maize breeding programs. This research has resulted in the development of quality protein maize (QPM) which contains the opaque 2 gene and numerous modifier genes which lead to maize varieties that are rich in two amino acids: Lysine and Tryptophan. Results from animal feeding trials conducted in Ghana and other parts of the world with poultry and pigs confirmed the superiority of QPM in nutritional value over normal maize. Quality protein maize stimulated better growth in pigs and poultry when it was used as the only source of protein.

Africa RISING and its predecessor projects supported the testing of QPM varieties in Zambia. In September 2015, the Seed Control and Certified Institute (SCCI) of Zambia approved the release of two QPM hybrids (GV 682P and GV 687P) which contain 0.08% of Tryptophan and about 4% of Lysine per grain weight. These two hybrids were evaluated on-station along with best commercial control varieties. Besides having high lysine and tryptophan they also have other adaptive traits, such as drought tolerance and resistance to major maize diseases (GLS and MSV).

The new QPM hybrids were comparable in their performance to the best commercial hybrids in the market. While developing these hybrids, there was strong emphasis in selecting them under drought and low-N stress, and favorable rain-fed environments. In multi-locational trials conducted for two seasons these QPM hybrids showed a yield advantage of 5% to 10% over non-QPM control varieties under drought, and were also comparable to local control varieties under favorable conditions. Laboratory results additionally showed that drought and low soil fertility can dramatically reduce grain protein content but not the quality. However, in terms of yield there was no detectable yield penalty associated with QPM hybrids.

To bridge the gap between breeders and farmers and to ensure that new varieties fit farmers' preferences and suit their socioeconomic situations, they were evaluated under farmers' conditions. The on-farm results indicate that most farmers preferred the new QPM varieties based on high-yielding characteristics, early maturity and drought tolerance. Grain yield was considered the most important selection criteria. However, drought-tolerance was viewed by farmers as a way to ensure early provision of food to the households, alleviate hunger and to cope with unreliable rainfall.

These results confirm that given the time, attention and resources CIMMYT's QPM research program has received also through Feed the Future funding, smallholder farmers will be able to adopt QPM hybrids in the near future, which will increase their food and nutrition security.

Right: Mrs. Mary Sikiriwai shows the performance of her quality protein maize (QPM) plot. QPM varieties are just like ordinary maize but have significantly higher levels of essential amino acids Lysine and Tryptophan.

Photo: Peter Setimela

Making seed accessible to smallholder farmers

By Johnson Siamachira and Peter Setimela

Smallholder farmers in Zambia need improved access to technologies that will enable them to increase farm yields while being more resilient in order to reduce poverty, increase food security as well as economic growth. These technologies range from improved seed varieties and fertilizers to more climate-smart agriculture systems such as conservation agriculture, which have shown to be successful elsewhere. Farmers also need private sector involvement, without which no country will make headway in development.

To facilitate farmers' access to improved seeds at affordable prices, CIMMYT provides support to seed companies in seed business development, including capacity building for technical and entrepreneurial skills, varietal release and registration, seed multiplication and commercialization.

Photo: Peter Lowe

In Zambia, one of the companies benefitting from CIMMYT's breeding and seed systems work is Afriseed, a brand product under the auspices of Stewards Globe Limited. Working through USAID's Africa RISING and Drought-tolerant Maize Seed Scaling (DTMASS) projects, the company has managed to establish a wide product range from maize hybrids, including open pollinated varieties (OPVs) to legumes such as beans, cowpeas, groundnuts and soy beans.

Established in 2007, Stewards Globe has received CIMMYT support to scale out its drought tolerant maize varieties and legumes across drought prone areas and USAID's Feed the Future (FTF) Zones of Influence in Zambia, in addition to legumes. "We have received much needed training and technical support from CIMMYT to produce products that are on demand by farmers. This is critical to respond to and satisfy farmers' needs,'' Stephanie Angomwile, the chief executive officer of Stewards Globe says.

In her view, drought-tolerant maize varieties outperformed traditional maize in the 2015/2016 cropping season. However, "marrying the deployment of drought-tolerant maize with something like a crop insurance product against catastrophic weather events would reduce the risk of crop failure while increasing grain harvests for farmers."

Stewards Globe identified consumers who could buy seed in bulk as part of its turn-around strategy, as it had been a loss-making venture before 2014. As a result, the company transformed into the largest supplier of legume seed in the country, although nationally legume production is still low. Until recently the country had to import legumes from Malawi and South Africa to fill the gap. With the increased interest by USAID and many other players in outscaling legume seed in eastern Zambia, the company could find a larger market for their legume seed.

Without its own breeding program, Stewards Globe relies on CIMMYT and the Zambian Agricultural Research Institute for training and technical support and initial breeders' seed. They also work with extension agencies to train smallholder farmers on quality standards, field inspection and isolation distances to ensure the seed they produce meets the required standards. "As an emerging seed company, partnerships are very important for us to grow the seed industry. Support in germplasm through CIMMYT makes our life easier,'' said Angomwile. "By pulling together the right partners we will be able to achieve a much broader impact."

To date, Zambia has a 40-60 % hybrid maize adoption, and there is still room for growth in this industry as the country has sufficient farming land. "What we need is to increase farmers' knowledge on good agricultural practices and make seed available where it is needed most," said Angomwile. For Stewards Globe, promoting maize and legume seeds in tandem makes business sense as farmers need to rotate or intercrop their crops as integral part of the climate-smart agriculture practices now heavily promoted in Zambia.


Photo: Stephanie Angomwile

Sustainable Intensification Practices - a ray of hope for farmers facing El Niño induced drought

By Munyaradzi Mutenje, Angeline Mujeyi, Mulundu Mwila & Mully Phiri

Smallholder farmers in eastern Zambia, whose livelihoods are heavily dependent on rain-fed agriculture, have been increasingly exposed to rising intensity and frequency of El-Niño induced droughts. Recurrent droughts have escalated over the past 35 years with serious droughts in 1982/83; 1991/92; 1993/92; 1997/98; 2002/03; 2004/05; 2007/2008 and 2015/16. Erratic rains and prolonged dry spells have adversely affected agricultural production and sustainability of rural livelihoods in those years.

The current 2015/16 El Niño-induced drought is predicted to reduce maize yield by more than 40% in eastern Zambia, with the valley areas heavily affected (WFP, 2016). High levels of poverty among smallholder farmers (78%), insufficient resilience, economic diversification and investment initiatives leave farmers vulnerable to these climate shocks. Predicted increases in intensity and frequency of droughts are likely to exacerbate climate-induced economic shock in the next decades, pushing farmers into a vicious cycle of poverty.

The socioeconomic team under the Africa RISING Project carried out a study to understand the smallholder farmer's perception of El-Niño-induced droughts, their impacts on their socioeconomic activities and their adaptation strategies at the household level. In this study, adaptive capacity is defined as the ability of a system to adjust to climate shocks (including prolonged in-season droughts and shorter growing seasons <100 days), to moderate potential damages, to take advantage of opportunities or to cope with the consequences. The adaptive capacity of communities depends on many factors such as a) household resource endowments; b) strong social network; c) climate-resilient farming technologies; d) access to inputs; e) knowledge of climate risk; d) agricultural extension services; f) rural financial markets; and g) marketing and storage systems. Although Zambia has an early warning system, forecasting institutions are inadequately equipped and communication to extension officers and farmers in user-friendly formats is limited.


Photo: Christian Thierfelder

Using participatory rural appraisal (PRA) tools such as trend analysis, hazard and vulnerability mapping, the study team profiled the climatic context of farmers for the past 35 years (e.g. rainfall and temperature changes, hazard profiles, and community risk analysis). Key emphasis was on the years when there were poor onset of rains, early termination of the season, poorly distributed and erratic rains and excessive rains. The PRAs captured existing perceptions of climate change and adaptation measures that are

already used and feasible to attenuate the impact from six Africa RISING communities that are representative of the diversity of dynamics in eastern Zambia. Using descriptive analysis the PRA qualitative and quantitative findings were consolidated using protocols and summary matrices.

Overall, all the communities perceived that the rainfall pattern had changed considerably compared to 15 years ago. For communities in Chipata district, the growing seasons have become shorter, characterised by late onset and early termination of the season and prolonged dry spell. In the low altitude and low rainfall parts of eastern Zambia (e.g. Lundazi district) the length of the growing season has not changed but the rainfall has become more unevenly distributed in the past five seasons with either more rainfall at the start or end of the season. For Sinda district, communities have observed significant changes in the distribution of the rainfall with more frequent early and mid-season dry spells.

The PRA findings from the three districts revealed that smallholder farmers use agricultural technology innovations and diversification strategies to manage droughts and enhance their resilience to climate shocks. Communities in Lundazi use a combination of ex-ante coping strategies, which include drought tolerant, varieties of different maturity groups, diversity of tillage systems and cropping patterns, staggered planting and micro-dosing of fertilizers. Increased yields and income from a combination of ripped maize-cowpea intercropping, drought tolerant maize varieties such as PAN53 and SC633, and incorporation of sunflower to the more common maize-legume cropping system in the 2014/15 season resulted in spontaneous adoption of these technologies in the 2015/16 season. Similarly in Kawalala Camp, Sinda district, increased yield and income from ripped maize-soybean rotations in the 2014/15 cropping season achieved spontaneous diffusion of these technologies in the 2015/16 season.

The farmers reported an adoption rate of more than 80%. It was however noted that those who did not adopt had limited access to ripping - either they did not have access to animal traction or no money to pay for the services. The income from crop sales were invested in livestock, mainly cattle, further enhancing their resilience in both districts. Crop, variety and spatial diversification were the commonly used drought management strategies used in Chipata district. Growing of more than four maize varieties in three different locations (homestead, dambo, and main field) and at least two cash crops (soybean, tomatoes, tobacco, common bean) have become an integral component of their farming system.

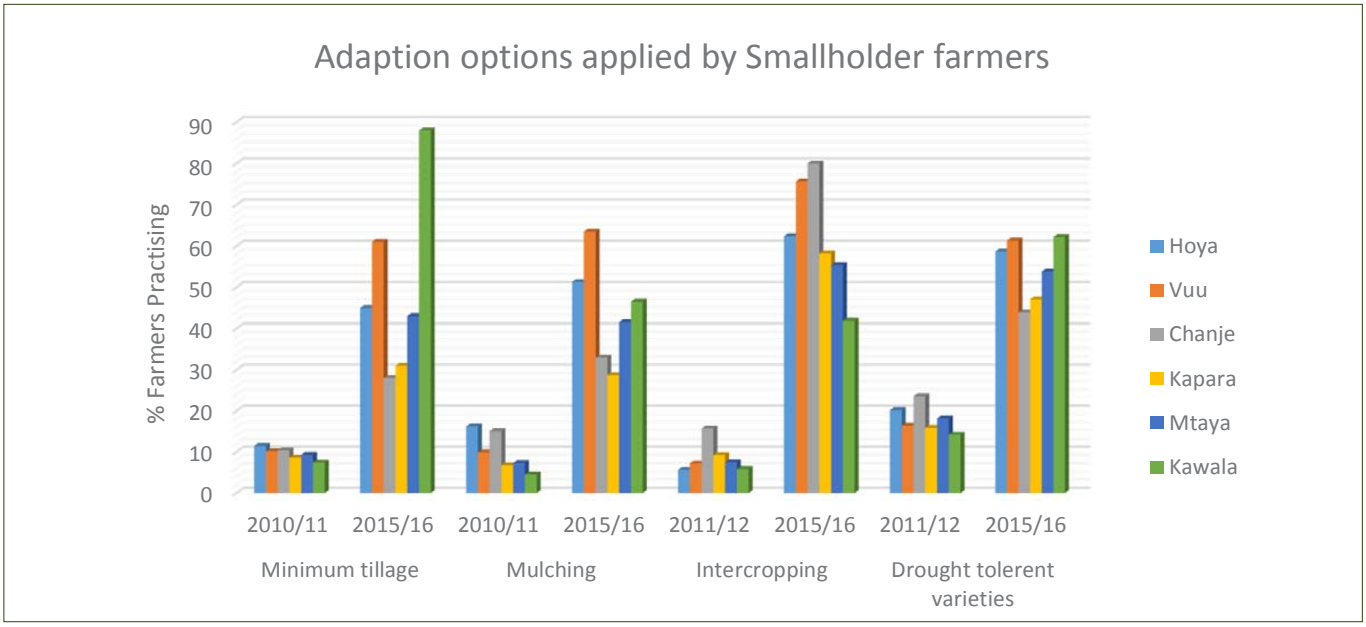

Figure: Extent of adoption of sustainable intensification practices in target communities of eastern Zambia in 2010/11 to 2015/16

The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action, research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. africa-rising.net/

Photo: Christian Thierfelder

CIMMYT
International Maize and Wheat Improvement Center

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

IFPRI

IITA
Research to Nourish Africa

ZARI
Zambia Agriculture Research Institute
Researching Soils, Crops and Water in Zambia

TLC

COMACO
Community Markets for Conservation

CRS
CATHOLIC RELIEF SERVICES

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